2.0 Air Resources

2.1 Regulatory Framework

Air quality in the United States is protected by the Environmental Protection Agency (EPA) through Federal laws known as the Clean Air Act (CAA) of 1977 and the Clean Air Act Amendments (CAAA) of 1990. EPA has largely delegated the task of permitting and tracking air pollution sources to the States, including Mississippi, by approving State Implementation Plans (SIPs). All sources of air pollution at SSC are regulated by the State of Mississippi's Department of Environmental Quality (MDEQ), Office of Pollution Control.

The CAAA are focused on six criteria pollutants: Carbon Monoxide (CO), Lead (Pb), Nitrogen Dioxide (NO_2), Ozone (O_3), Particulate Matter less than 10 micrometers in diameter (PM_{10}), and sulfur oxides (measured as SO_2). The current list of criteria pollutants and the National Ambient Air Quality Standards (NAAQS) are shown in Table 2 - 1. Mississippi Ambient Air Quality Standards (MAAQS) are the same as the National Standards. SSC is considered an "attainment" area for all air quality standards.

The State of Mississippi has adopted by reference the National Emissions Standards for Hazardous Air Pollutants (NESHAP) 40 CFR 61 and 40 CFR 63 and the Title III provisions of the 1990 CAA Amendments (CAAA). The NESHAP program includes standards that regulate specific categories of stationary sources that emit or have the potential to emit hazardous air pollutants. Currently, SSC operates under a Title V Operating Permit issued by the MDEQ on February 5, 1998.. On March 27, 2001, SSC obtained a Prevention of Significant Deterioration (PSD) permit. .

2.2 Meteorology

SSC lies within a Humid Subtropical region based on the Köppen-Geiger system of climate classification. The climate is characterized as a Cfa climate type, typified by the absence of a dry season. The climate is temperate and rainy with hot summers.

The average annual temperature at SSC is about 19° centigrade (C) (66° Fahrenheit [F]). Average seasonal temperatures are 12° C (53° F) in the winter; 18° C (65° F) in the spring;

Table 2-1
National and State Ambient Air Quality Standards

Pollutant	National Primary Standard ($\mu g/m^3$)	National Secondary Standard ($\mu g/m^3$)	Mississippi Standard ($\mu g/m^3$)
Particulate Matter			
PM_{10}, Annual [a]	50	50	50
PM_{10} 24-hour [b]	150	150	150
Sulfur Dioxide			
SO_2, Annual[c]	80	None	80
SO_2, 24-hour[d]	365	None	365
SO_2, 3-hour[d]	None	1300	1300
Carbon Monoxide			
CO, 8-hour[d]	10,000	None	10,000
CO, 1-hour[d]	40,000	None	40,000
Nitrogen Dioxide			
NO_2, Annual[c]	100	100	100
Ozone			
O_3, 1-hour[b]	235	235	235
Lead			
Pb, calendar quarter[c]	1.5	None	1.5

[a] Standard is attained when the expected annual arithmetic mean is less than or equal to 50 $\mu g/m^3$.
[b] Standard is attained when the expected number of exceedances is less than or equal to 1.
[c] Never to be exceeded.
[d] Not to be exceeded more than once per year.

Source: 40 CFR Part 50, National Primary and Secondary Ambient Air Quality Standards, and Mississippi Air Emission Regulation APC-S-4.

26° C (79° F) in the summer; and 18° C (64° F) in the fall. During June through August approximately 65% of the days have maximum temperatures exceeding 35° C (95° F) and ground level relative humidity greater than 70%. Cold weather occurs predominantly between mid-December and March, with the coldest weather generally occurring in January and February. Extended periods of freezing temperatures are rare.

On the average, there are only 84 clear days per year. For the rest of the year it is typically partly cloudy 114 days and cloudy 167 days. Sunshine occurs approximately 58% of the possible hours. It is frequently foggy from mid-October to May. Heavy fogs limiting surface visibility to one-fourth mile or less occur on an average of 42 days per year, usually during late night and early morning hours.

Rainfall averages about 1.5 meters (60 inches) per year but varies by plus or minus 0.5 meters (20 inches) per year. There is no clear pattern of rainfall distribution throughout the year, although July and August are typically the wettest months and October is typically the driest. Table 2-2 summarizes the average temperature and precipitation for 1992-1995.

Prevailing surface winds are from the south and southeast through two thirds of the year and from the north for the rest of the year while upper level winds generally prevail from the west and southwest. Northern winds normally occur from August through February. The hurricane (tropical cyclone) season runs from June to November. Cyclone intensity ranges from weak to large and intense with maximum wind speeds approaching 320 kilometers (200 miles) per hour. The Gulf Coast averages one tropical cyclone per year; approximately two thirds of these are of hurricane force with winds greater than 119-kilometers (74 miles) per hour. Only a fraction of the hurricane-force cyclones cause severe damage to the areas along the Gulf Coast.

SSC maintains daily surface meteorological data using a remotely controlled "Handar" system. The data is maintained in a database and is available by request to NASA Environmental Management. Information maintained in the database includes ambient air temperature, precipitation, relative humidity, barometric pressure, wind speed and direction. There are also several years of upper air data that was collected daily and is archived with NASA Environmental Management. Additional meteorological data is available for Slidell, LA and New Orleans, LA through the National Climatic Data Center.

Table 2-2
Summary of Average Temperature and Precipitation Data for
NASA Stennis Space Center (1992-2000)

Month	Temperature °C (°F)			Precipitation, Centimeters(inches)
	Average	Average Minimum	Average Maximum	Average
January	9.6 (49.3)	3.7 (38.7)	15.6 (60.0)	14 (5.8)
February	10.3 (50.6)	3.2 (37.7)	17.2 (62.9)	10 (4.3)
March	14.9 (58.9)	8.0 (46.3)	21.4 (70.5)	12 (5.1)
April	19.5 (67.1)	13.5 (56.4)	25.9 (78.6)	10 (4.2)
May	22.5 (72.5)	16.1 (61.0)	28.8 (83.9)	13 (5.3)
June	25.7 (78.3)	19.5 (67.1)	32.1 (89.8)	10 (4.1)
July	26.6 (79.9)	21.2 (70.2)	32.6 (90.7)	15 (6.2)
August	26.4 (79.5)	21.1 (69.9)	32.4 (90.3)	16 (6.6)
September	24.6 (76.2)	18.9 (66.1)	30.6 (87.0)	13 (5.5)
October	20.1 (68.2)	12.2 (53.9)	26.6 (79.8)	7 (2.9)
November	14.3 (57.7)	6.9 (44.5)	21.2 (70.2)	10 (4.1)
December	11.2 (52.2)	5.3 (41.6)	17.6 (63.7)	13 (5.6)

2.3 SSC Air Quality

SSC is considered to be in a rural area for air quality. It will probably remain rural due to NASA's restrictive easement surrounding the facility. The ambient air quality of Mississippi is considered attainment for PM_{10}, ozone (O_3), carbon monoxide (CO), sulfur dioxide (SO_2), and Nitrogen Oxides (NO_x), and lead (Pb). According to the May 1995 compliance assessment for SSC's Title V permit application, Stennis Space Center is within all compliance requirements for federal and state emissions regulations.

2.4 SSC Air Pollution Sources

All SSC air pollution sources are listed in the Title V Operating Permit. Total emissions from these sources are estimated on an annual basis for submission to the MDEQ as the Fee Summary Report. This report is used by the State to determine the fee SSC is required to pay to the State for tons of emissions per year. NASA Environmental Management maintains an Air Management System spreadsheet for collection of site data to estimate emissions.

2.4.1 Criteria Pollutants

Diesel fuel burning sources covered in the Title V Permit are summarized in Table 2-3. A list of other point sources that produce air emissions is provided in Table 2-4. These sources include fuel dispensing operations, freon recovery, abrasive blast operations, degreasing, rocket testing and flare stacks.

2.4.2 Toxic Air Pollutants

Toxic substances are released to the atmosphere through fugitive and point source emissions. Table 2-5, which lists the compounds, was generated from the emissions summary for SSC's Title V Permit. The inventory only identifies Hazardous Air Pollutants (HAPs) contained in Title III of the CAAA. The point source emissions are generally small quantities generated from calculations for releases from diesel fueled generators. The largest single point source for hazardous air pollution is the batch vapor degreaser. This degreaser uses 1,1,1,-trichloroethane and is regulated by NESHAPS 40 CFR 63 Subpart T. Appendix A lists the original 189 Hazardous Air Pollutants (HAP) of the CAA. Caprolactam has been delisted from the original list.

As of April 2001, EPA is near the proposal phase of a new Maximum Achievable Control Technology (MACT) standard for HAP emissions from Rocket Test Facilities under 40 CFR Part 63. Although SSC may be included as an affected facility in this new regulation, preliminary communications with EPA indicates that the new standard will not require any new controls on test operations. The new regulation is scheduled for proposal in May 2001 and promulgation by mid-2002.

2.4.3 Ozone-Depleting Pollutants

Following the 1987 United States ratification of the "Montreal Protocol on Substances that Deplete the Ozone Layer" and the 1988 EPA limitation on chlorofluorocarbon and Halon production, Stennis Space Center instituted its Chlorofluorocarbon (CFC) and Halon Compounds Reduction and Phase-out Plan in 1993 and the last revision is dated September 2000. The SSC plan is in accordance with Title VI of the Clean Air Act Amendments, which requires a phase-out of production of ozone-depleting materials (such as CFCs, halons, carbon tetrachloride, methyl chloroform, and hydrochlorofluorocarbons (HCFCs)).

In 1993, older refrigeration systems using CFC-11 or CFC-12 within Stennis Space Center were placed under a replacement or retrofit strategy or a continuance plan to sustain operation from a refrigerant stockpile until the end of service life. A recycling and recovery system was initiated for refrigerant removal and repair. As part of the phase-out plan, consumption data for CFCs and other ozone-depleting compounds is collected through a yearly CFC/Halon questionnaire and Materials Requirements Report. Currently, consumption is tracked for NASA Environmental Management by the Facility Operations and Support Service Contractor. Since the implementation of the phase-out plan in 1993, SSC has reduced its use of CFCs and methyl chloroform and terminated its use of Halons. Table 2-6 summarizes the results of the most recent CFC/Halon inventory for fiscal year 2000.

2.5 Major Environmental Considerations for Proposed Actions

When developing new projects at SSC, air pollution issues are identified through the Preliminary Environmental Surveys (PES) SSC Form # 696M. Any potential emissions of any compound must be considered to determine whether notification needs to be sent to the MDEQ or EPA Region IV and if a modification to the SSC Title V operating permit must be obtained, or whether a particular level of control technology has been mandated for a specific pollutant. Any project that may involve the use of CFCs, Halons, methyl chloroform, carbon tetrachloride, and air toxics included in Title III of the CAAA should be reconsidered to determine if suitable replacements for these compounds exist. In any case, the evaluation for the air quality impacts of a new project must be coordinated through NASA Environmental Management.

Under the State of Mississippi's Air Pollution Control Regulations, it is the responsibility of the facility to apply for the proper permit for any source of dust, fumes, mist, smoke, particulate matter, vapor, or gas, regardless of the quantity released. In view of the current state regulations and of developing regulations under the CAAA, air pollution issues must be considered at the beginning of any project-planning phase.

Table 2-3
Summary of SSC Air Emission Point Sources for Diesel Fuel Burning Equipment

Emission Unit ID No.	Title V ID No.	Serial No.	Rating (KW)
1000-4A	AA-044	25702109	1750
1000-6A	AA-047	4262	500
1000-7A	AA-048	6006	500
1000-E1N	AA-045	66-J1-1016	750
1000-E2S	AA-046	98875	750
4400-02 (C#1)	AA-051	6240	1500
4400-03 (C#2)	AA-052	6241	1500
4400-04 (C#3)	AA-053	6239	1500
4400-05 (C#4)	AA-054	6242	1500
4400-06 (N#1)	AA-055	GR-1030-0930	3475
4400-07 (N#2)	AA-056	GR-1030-0938	3475
4400-08 (N#3)	AA-057	GR-1030-0931	3475
4400-09 (N#4)	AA-058	GR-1030-0939	3475
4400-10 (N#5)	AA-059	GR-1030-0932	3475
4400-11 (N#6)	AA-060	GR-1030-0940	3475
4400-12 (N#7)	AA-061	GR-1030-0933	3475
4400-13 (N#8)	AA-062	GR-1030-0941	3475
4400-14 (N#9)	AA-063	GR-1030-0934	3475
4400-15 (N#10)	AA-064	GR-1030-0942	3475

Emission Unit ID No.	Title V ID No.	Serial No.	Rating (KW)
1100-3A	AA-001	1935	140
1201-3A	AA-002	6BA0214	300
2105-01	AA-003	RZ00645	100
2105-02	AA-004	UZ00334	100
2105-04	AA-006	FZ1017	100
2105-07	AA-009	FZ1256	100
2105-09 (3203)	AA-011	FZ1035	100
2105-10	AA-012	RZ01112	100
2105-12	AA-014	RZ00689	100
2105-14	AA-016	FZ04636	60
2105-16	AA-018	FZ01664	60
2105-23	AA-025	FZ02328	60
2105-24A	AA-026	RZ00559	200
2105-27 (2201)	AA-029	RZ00524	200
2105-28	AA-030	RZ00545	200
2105-31	AA-031	FZ01455	60
2105-32	AA-032	RZ00398	100
2205-4	AA-034	I883170	30
2205-5	AA-035	I883169	30
8120(A)-01	AA-043	A89019668	30
2205-6	AA-036	I883171	60

Emission Unit ID No.	Title V ID No.	Serial No.	Rating (KW)
2205-7	AA-037	93050319	60
2205-8	AA-038	90-25475	100
2205-9	AA-039	C931480	100
2205-10	AA-040	FZ1032	100
2205-11	AA-041	96B6B	300
2205-12	AA-042	9409-42	300
2205-14	AA-033	I883172	60

Table 2-4
Other Air Emission Point Sources

Manufacturing Processes	Title V ID No.	Operations	Pollutants
Fuel Dispensing	AA-080 AA-081 AA-082	3-8,000 gallon tanks	VOC
Freon Recovery	AA-083	Freon Still	CFC-113, HCFC-225
Abrasive Blast	AA-084	B3202 Abrasive Blast	PM
Degreasing	AA-085	Batch Vapor Degreaser	HAPs
Rocket Testing	AA-086 AA-087 AA-088 AA-089 AA-090 AA-095 AA-096 AA-099 AA-100 AA-101	E-1 Test Cell 1 E-1 Test Cell 2 E-1 Test Cell 3 E-1 Test Cell 4 H-1 Test Cell 7 E-2 Test Cell 5 E-2 Test Cell 6 B1/B2 Test Stand A1 Test Stand A2 Test Stand	CO, SO_2, NO_x, PM Fluorine
Flare Stacks	AA-091 AA-092 AA-093 AA-094 AA-097 AA-098 AA-102	E-1 Turbine Exhaust Flare E-1 Turbine Exhaust Flare E-1 Pump Flare E-1 Pump Flare E-2 High Pressure Flare E-2 Flare System Hydrogen Flare w/propane pilot	

Table 2-5

Potential Toxic Emissions as Listed in Title V Application

Fugitive Release Pollutants	Point Source Release Pollutants
1,1,1-Trichloroethane	1,1,1-Trichloroethane
1,4-Dioxane	1,3 Butadiene
Carbon Tetrachloride	Acetaldehyde
Chloroform	Acrolein
Diethylene Glycol	Arsenic
Ethyl Benzene	Benzene
Ethylene Dibromide	Beryllium
Ethylene Glycol	Cadmium
Formaldehyde	Chromium
Glycol Ether	Formaldehyde
Hexane	Hydrogen Fluoride
Hydroquinone	Lead
Methanol	Manganese
Methyl Chloroform	Mercury
Methyl Ethyl Ketone	Nickel
Methyl Isobutyl Ketone	Toluene
Methylene Chloride	Xylenes
N-Hexane	
Napthalene	
Propylene Glycol Monomethyl Ether	
Styrene	
Tetrachloroethylene	
Toluene	
Xylene	

Source: NASA, Application for Title V Permit, Stennis Space Center, Mississippi, 1995.

Table 2-6
Class I Ozone Depleting Substances Survey, 2000

Compound	Applications	Total Usage Kilograms (Pounds)	Major Uses
CFC-113	cleaning/ verification of cleaning	5,321 (11,730)	B2205, B8110, B8100
Methyl Chloroform	Cleaning	3,980 (8,775)	Test Stands, B2205

Source: NASA, NASA Environmental Tracking System, 2000, John C. Stennis Space Center.

2.6 References

1. 40 CFR Part 50, National Ambient Air Quality Standards.

2. Mississippi Department of Environmental Quality, Office of Pollution Control, Mississippi Air Quality Regulations, Regulation APC-S-1 through APC-S-6.

3. NASA, 2000, Chlorofluorocarbon (CFC) and Halon Compounds Reduction and Phase-Out Plan.

4. NASA, 2000, NASA Environmental Tracking System, John C. Stennis Space Center.

5. NASA, 1995, Preliminary Assessment for SSC, Task Order No. 67, John C. Stennis Space Center, MS.

6. NASA, 1995, Title V Operating Permit Application for the John C. Stennis Space Center, Mississippi.